MEMO

To: Dave Samson
From: Richard Le
Re: Present worth issue
Cc: Ray Hoagland
Steve Cowdin

The Issue

There seems to be some misunderstanding about the present worth issue involving the calculation of costs for CALFED alternatives. This memo attempts to shed some more light to the issue.

Fact

It is true that over time the value or purchasing power of money changes, mainly because of time preference. A dollar in the future tends to be less valuable than a dollar today, or a dollar in the future is worth more today. For example, an item that costs $1 today will likely cost more than $1 in the future, or what can be bought in the future for $1 would likely cost more than $1 today.

The following table shows the value of money over time. In fact, it shows the present worth or value of $1 of the base year over time, backward and forward, at different discount rates.

VALUE OF MONEY OVER TIME

		DISCOUNT RATE (%)									
		1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
YEAR	(10)	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594
	(5)	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.611
	(4)	1.041	1.082	1.126	1.170	1.216	1.262	1.311	1.360	1.412	1.464
	(3)	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331
	(2)	1.020	1.040	1.061	1.082	1.103	1.124	1.145	1.166	1.188	1.210
	(1)	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100
BASE	-	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
	2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
	3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
	4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
	5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
	10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
	20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149
	30	0.742	0.552	0.412	0.308	0.231	0.174	0.131	0.099	0.075	0.057
	40	0.672	0.453	0.307	0.208	0.142	0.097	0.067	0.046	0.032	0.022
	50	0.608	0.372	0.228	0.141	0.087	0.054	0.034	0.021	0.013	0.009

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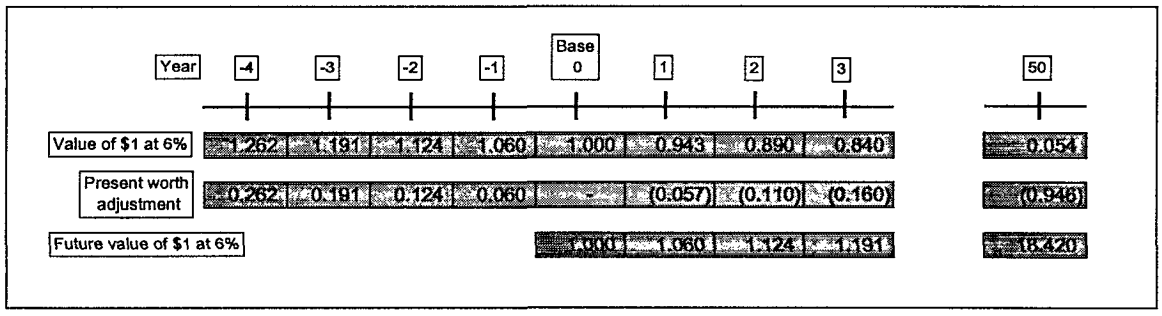
In the table the value of a dollar in the base year is always $1, no matter what the discount rate is. Suppose that the discount rate is constant at 6% every year, then in year 1 (one year after the base year) one dollar is worth only $0.943, in year 2, it is worth $0.890, in year 3, $0.840, etc. In other words, at the base year's prices, the present value (or worth) of a dollar 50 years from now at a constant discount rate of 6% per year is just $0.054.

One can look at the present worth issue from another angle. As shown in the picture below, in year 1, the value of a dollar is reduced by $0.057, in year 2, by $0.110, in year 3, by $0.160, and in year 50, by $0.946.



Now instead of looking forward from the base year on to year 1, 2, etc. ***after*** that, we can look backward to the years ***before*** the base year. This is equivalent to calculating the future value of $1 from the base year.

Suppose that this year 1998 is the base year, or year 0. As shown in the above figure, $1 in 1998, at a constant discount rate of 6%, will be worth $1.060 in 1999, $1.124 in 2000, $1.191 in 2001, and $18.420 in year 2048, etc.

The future values of $1 from the base year forward are the same as the present values of $1 from the base year going backward. In other words, what will cost $1 in 2001 would cost $1.191 today in 1998. The difference, $0.191 (= $1.191 - $1.000), is called present worth adjustment, or the increase in the future value of $1 over the present value.

CALFED Cost Determination

When the construction of a project spans a period of several years, this change in the value of money must be taken into account so that the costs are accurately determined. It is true with the determination of costs for CALFED alternatives.

Assume that the base year is the year when construction is completed, and the construction of a reservoir takes five (5) years. To calculate the construction costs accurately, the present worth adjustments must be added to the costs. The final figures are the total capital costs of construction when the reservoir is completed.

Since the current present-worth approach used in calculating capital costs for CALFED alternatives is the right one, I suggest that no change should be made.

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VALUE OF MONEY OVER TIME

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YEAR	(10)	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594
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